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Research Article

RESPONSE OF FOLIAR SPRAY OF UREA, BORON AND 2,4-D IN ACID LIME (*Citrus aurantifolia* Swingle) UNDER MALWA PLATEAU CONDITIONS

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Abstract- The present investigation was carried out in the Department of Fruit Science, College of Horticulture, Mandsaur, Madhya Pradesh, India during 2015-16 on eight years old plant of acid lime. There were twelve treatments comprising of three levels of urea (1%, 2% and 3%), boron (0.4%, 0.6%and 0.8%) and 2,4-D (10, 20 and 30 ppm), and their combinations (Urea 1% + Boron 0.4% + 2,4-D 10 ppm, Urea 2% + Boron 0.6% + 2,4-D 20 ppm and Urea 3% + Boron 0.8% + 2,4-D 30 ppm) with control. The experiment was laid out in Randomized Block design with three replications. Foliar spray was done on first week of July and same spray was repeated after 30 days with the urea, boron, 2,4-D and their combinations at pea stage of fruit. It was found that foliar spray of urea 3% + boron 0.8% + 2,4-D 30 ppm significantly increased the plant height and canopy spread (E-W and N-S direction), and also showed the better result for leaf length, leaf width and leaf area. However, foliar spray of urea 2% + boron 0.6% + 2,4-D 20 ppm gave the best values for number of flowers per plant, fruit set, fruit retention and fruit drop.

Keywords- Urea, Boron, Acid Lime and 2,4-D.

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Introduction

Acid lime (*Citrus aurantifolia* Swingle), from the family Rutaceae probably originated in India and then spread to the Middle East and other tropical and subtropical countries. It is generally grown under both tropical and subtropical climatic conditions. It is a rich source of vitamin "C" and has good antioxidant properties. its value-added products like pickle, juice, squash, lime peel oil, and peel powder etc are also in great demand in soap and cosmetic industry [1]. Plant growth regulators play a significant role in regulation of flowering, thinning of flower and fruit, prevention of pre-harvest fruit drop, etc. Among, various plant growth regulators 2,4- D is an important growth regulator of auxin group, which helps to reduce fruit drop and to improve fruit set and quality. On the other hand, foliar nutrition is practiced by the fruit grower's worldwide. Foliar sprays of urea at pea or marble stage significantly increased vegetative growth. Spray of urea increased minimum duration of flowering and maximum number of flowers in *Kagzi* lime trees. The minimum fruit drop and maximum fruit retention were also recorded in the same treatment. The percentage of fruitlet thinning increased with the increase in urea concentration. Boron is important element for flowering, fruiting, growth and quality of fruits. Boron also increases the chlorophyll content of leaves and plays an important role in enzymatic activities. In citrus, B deficiency leads to low sugar content, granulation and excessive fruit abortion [2] as well as rind thickening; symptoms that are seen regularly in fruit grown here in Arizona. Increases in fruit set from B have been reported on 'Redblush' grapefruit [3] and 'Hamlin' oranges, but no response on 'Lisbon' lemons [4]. So, it has to be need of foliar application of boron for role in the yield and fruit quality of citrus [5].

Materials and Methods

An experiment was conducted during 2015-2016 at the *Instructional cum Research Fruit Orchard,* Department of Fruit Science, K.N.K. College of Horticulture, Mandsaur (M.P) on well-established Eight years old orchard of acid lime. The experiment was laid out in Randomized Block Design (RBD) with three replications, keeping each treatment on one plant. There were twelve treatments comprising of three levels of urea (1%, 2% and 3%), boron (0.4%, 0.6%and 0.8%) and 2,4-D (10, 20 and 30 ppm), and their combinations (Urea 1% + Boron 0.4% + 2,4-D 10 ppm, Urea 2% + Boron 0.6% + 2,4-D 20 ppm and Urea 3% + Boron 0.8% + 2,4-D 30 ppm) with control. Foliar spray was done on first week of July and same spray was repeated after 30 days with the urea, boron, 2,4-D and their combinations at pea stage of fruit. The brief description of materials used and techniques employed in carrying out the investigation are given as the growth *i.e.* plant height, canopy spread (east-west and north – south direction), leaf length, leaf width of the plants was measured with the help of measuring device, while reproductive parameters like total numbers of flower per plant were counted manually at full bloom stage from tagged twig of plant, fruit setting , fruit drop and fruit retention at maturity were calculated with following formula:

Fruit setting (%) = (Number of set fruits/ Number of flowers) x100

Fruit drop (%) = (Total number of fruit set - Total number of fruits at harvest time) x 100/ Total number of fruit set.

Fruit retention **(%)** = Number of fruits at harvest / Initial number of fruit set x100

Results and Discussion

Growth parameters:

The maximum increase in plant height (0.53 m), increase in canopy spread N-S direction (0.55 m) and E-W direction (0.57 m), leaf length (6.29 cm), leaf width (3.62 cm) and leaf area (62.12 cm^2) were noticed with the application of urea 3% + boron 0.8% + 2,4-D 30 ppm which was significantly superior over the other treatments. Enhancement in growth of plant might be due to the application of nutrient of 2,4-D help in cell elongation and enlargement. The increased uptake of water and nutrients due to persuasive swelling forces leading the softening of cell

wall and thereby, favoured better development of plants resulting in greater height and number of branches per plant and ultimately the greater plant spread. These results are in close conformity with those reported by [6-8]. Boron increases the phenolic compounds which regulate polar auxin transport. The increased auxin activity results in increased vegetative growth characters. The present results in kinnow are in line with those of [9] in citrus. The increase in vegetative growth of the plant by urea attributed to the association of nitrogen in the synthesis of protoplasm and in the primary manufacture of amino acids a nd increased auxin activities. As a result, meristematic activities increase which in turn increase the vegetative growthas reported by [6,10,7] in citrus.

Table-1 *Response of foliar spray of urea, boron and 2, 4-D on growth and reproductive parameter of acid lime.*

Treatments	Plant height (m)	Plant spread E-W (m)	Plant spread N-S (m)	Leaf length (cm)	Leaf width (cm)	Leaf area (cm^2)	Number of flower per plant	Fruit setting (%)	Fruit drop (%)	Fruit retention (%)
Control (Water spray)	0.31	0.39	0.38	4.13	2.27	39.23	1128.00	35.42	58.09	41.91
Urea (1%)	0.40	0.48	0.46	5.67	3.29	53.75	1427.00	41.67	50.86	49.14
Urea (2%)	0.42	0.50	0.48	5.81	3.37	55.50	1612.00	47.95	54.62	45.38
Urea (3%)	0.44	0.52	0.5	5.94	3.43	57.07	1544.00	44.58	55.15	44.85
Boron (0.4%)	0.35	0.43	0.41	5.10	2.73	44.43	1316.00	49.37	50.38	49.63
Boron (0.6%)	0.36	0.45	0.43	5.23	2.93	46.50	1410.00	52.10	48.48	51.52
Boron (0.8%)	0.37	0.47	0.45	5.42	3.17	48.50	1504.00	54.18	47.35	52.65
2,4-D (10 ppm)	0.37	0.44	0.42	5.53	3.01	51.22	1331.00	50.00	42.77	57.23
2,4-D (20 ppm)	0.38	0.46	0.44	5.79	3.10	52.91	1426.33	54.19	41.79	58.21
2,4-D (30 ppm)	0.40	0.48	0.46	5.82	3.27	54.72	1577.33	56.27	40.77	59.23
Urea (1%) + Boron (0.4%) + 2,4-D (10ppm)	0.49	0.53	0.51	5.98	3.47	58.23	1730.67	58.78	40.27	59.73
Urea (2%) + Boron (0.6%) + 2,4-D (20ppm)	0.51	0.55	0.53	6.11	3.59	60.30	1904.67	64.69	36.19	63.81
Urea (3%) + Boron (0.8%) + 2,4-D (30ppm)	0.53	0.57	0.55	6.29	3.62	62.12	1829.33	60.33	38.93	61.07
S.Em.±	**0.008**	**0.007**	**0.005**	**0.31**	**0.20**	**0.82**	**50.29**	**1.48**	**1.41**	**1.56**
C.D. at 5%	**0.023**	**0.022**	**0.015**	**0.90**	**0.60**	**2.41**	**146.80**	**4.33**	**4.12**	**4.55**

Reproductive parameters:

The minimum fruit drop (36.19%) and maximum average number of flower per plant (1904.67), fruit set (64.69%) and fruit retention (63.81%) with the application of T_{11} (urea 2% + boron 0.6% + 2,4-D 20 ppm) which was significantly superior than all over treatments and maximum fruit drop (%) (58.09) was observed in control, it is evident by the data presented in [Table-1]. The obtained results go in line with the findings of [11-13]. The increase in reproductive parameters may be due to that the nitrogen is an important component of protoplasm and it helped in chlorophyll synthesis which, increase in photosynthetic rate resulting more accumulation of carbohydrates leading to flower initiation and profuse flowering. The foliar application of boron the fruit drop was reduced as research shows that boron is required for the synthesis of Tryptophan, which in turn is the precursor for the synthesis of Auxin might have caused the delay in the formation of abscission layer through preservation of loss of pectin material in middle lamella, and prevented fruit drop [14] in litchi. The higher fruit set by 2,4-D application might have been due to its beneficial effect on pollen germination and pollen tube growth. Increase in fruit retention and fruit number might be due to reduction in the fruit drop. 2,4-D also improved the fruit set. Exogenous applications of 2,4-D coupled with natural endogenous auxin might have been responsible for increase in fruit set. Similar results have also been reported by [15] in citrus.

Conclusion:

On the basis of results obtained in present investigation it is concluded that foliar spray of urea 3% + boron 0.8% + 2,4-D 30 ppm was found to be the best for growth parameter plant height (m), canopy spread (E-W and N-S), leaf length, leaf width and leaf area followed by treatment urea 2% + boron 0.6% + 2,4-D 20 ppm and reproductive parameters like number of flower per plant, fruit setting, fruit drop and fruit retention was found best under treatment urea 2% + boron 0.6% + 2,4-D 20 ppm followed by treatment urea 3% + boron 0.8% + 2,4-D 30 ppm.

Application of research: The foliar spray of urea 3%+boron 0.8+2,4-D 30 ppm proved best for the growth parameters, followed by the foliar spray of urea 2%+boron 0.6+2,4-D 20 ppm. reproductive parameters (no. of flowers/per plant, fruit setting, fruit drop and fruit retention) was found best under the treatment urea 2%+boron 0.6+2,4-D 20 ppm followed by the treatment of urea 3%+boron 0.8+2,4-D.

Research Category: Horticulture

Abbreviations:

RDB: Randomized Block Design

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